Medical Student Experiences With Accessing and Entering Patient Information in Electronic Health Records During the Ob/Gyn Clerkship

Maya M. HAMMOUD, MD, MBA[1], Lauren M. FOSTER, MS[2], Monica M. CUDDY, MA[2], David B. SWANSON, PhD[3,4], Paul M. WALLACH, MD[5]

[1]University of Michigan Medical School
[2]National Board of Medical Examiners
[3]American Board of Medical Specialties
[4]University of Melbourne
[5]Indiana University School of Medicine

Study conducted in Philadelphia, PA

Disclosure statement: The authors report no conflicts of interest.

Funding: None

Prior presentation: This research was presented at the 2019 CREOG & APGO Annual Meeting, New Orleans, LA, February 26-March 2, 2019.

Corresponding Author:
Maya M. Hammoud, MD, MBA
Professor of Obstetrics/Gynecology
Professor of Learning Health Sciences
Associate Chair for Education
Director, Center for Education
Department of Obstetrics and Gynecology
University of Michigan Medical School
1500 E. Medical Center Dr.
L4000 Von Voigtlander Women's Hospital
Ann Arbor, MI, 48109
Phone: 734-936-3110
Fax: 734-936-7722
immaya@umich.edu

Abstract word count: 323
Main text word count: 3,072

Condensation

Some medical students may not receive sufficient experience entering information into electronic health records during the obstetrics and gynecology clerkship, which could result in lack of preparedness for residency.

Short Title: OBGYN Student use of EHRs

AJOG At a Glance:

A. This study examined medical student reported use of electronic health records during the obstetrics and gynecology clerkship.

B. While the majority of medical students viewed electronic health records, far fewer were able to enter notes and order.

C. Students may not receive adequate experience with entering information into electronic health records during the obstetrics and gynecology clerkship.

Abstract

Background: Medical school graduates should be able to enter information from patient encounters and to write orders and prescriptions in the electronic health record. Studies have shown that while students often can access EHRs, some students may receive inadequate preparation for these skills. Greater understanding of student exposure to electronic health records during their obstetrics and gynecology clerkships can help to determine the extent to which students receive the educational experiences that may best prepare them for their future training and practice.

Objective: To study medical student reporting of electronic health record use during the obstetrics and gynecology clerkship.

Study Design: A Step 2 Clinical Knowledge (CK) End-of-Examination Survey about electronic health record use was administered to medical students after they completed the Step 2 Clinical Knowledge component of the United States Medical Licensing Examination. For inpatient and outpatient rotations, students were asked if they accessed a record and if they entered notes or orders into it. Descriptive statistics for a sample of 16,366 medical students who graduated from LCME-accredited schools between 2012 and 2016 summarize student interactions with electronic health records by rotation type and graduation year. Chi-square techniques were used to examine mean differences in access and entry.

Results: The survey had an overall response rate of 70%. In 2016, the majority of survey respondents (94%) accessed electronic health records during their obstetrics and gynecology clerkship, but 26% reported “read-only” access. On the inpatient service, fewer than 10% of students reported any order entry, 58% reported entering progress notes, and 47% reported entering an admitting history and physical.

Conclusion: Medical school graduates entering obstetrics and gynecology residencies are expected to be competent in documenting clinical encounters and entering orders, including those that are unique to obstetrics and gynecology. This study shows that some students may receive less experience with entering information into electronic health records during their obstetrics and gynecology clerkships than others, which could result in unequal levels of preparedness for graduate medical education.

Key Words: electronic health records, medical education-clinical skills training, medical education-undergraduate, medical student and residency education

Introduction

The electronic health record (EHR) is a critical component of contemporary clinical practice. It can impact the doctor-patient relationship and is central to the collection and documentation of patient information to ensure high-quality patient care. In 2012, the Alliance for Clinical Education (ACE) recognized obtaining the knowledge and skills needed to effectively use EHRs as an important educational objective and encouraged medical educators to establish competencies for effective EHR use.[1] In 2014, the Association of American Medical Colleges (AAMC) published a document summarizing thirteen core entrustable professional activities (EPAs) expected of medical school graduates upon entry into residency training. Two of the EPAs directly address documentation of the patient encounter in the medical record[2,3] and one specifically pinpoints the ability to enter orders and prescriptions on paper and electronically.[3]

These efforts generally emphasize the need for medical school graduates to be able to enter information collected from patient encounters (e.g., history and physical, progress notes) and to write orders and prescriptions in EHRs.[1-3] It follows then that medical schools should strive to provide students with educational experiences that enable them to learn and practice the foundational knowledge and skills necessary to achieve a level of proficiency in EHR use that is appropriate for entry into residency training in any specialty. For example, the history and physical and progress notes used during the obstetrics and gynecology clerkship should include careful description of the pelvic examination, labor and delivery, and postpartum notes. Other clerkships, such as internal medicine, may not cover these topics. Entry of admission orders for labor and delivery, postpartum care, and perioperative care may similarly differ between clerkships.

Various studies have focused on student EHR use in the undergraduate medical educational environment. Many of them have shown that most students access EHRs while they are in medical school.[4-10] This is not surprising given the widespread use of EHR systems in clinical settings and calls to

incorporate instruction in EHR competencies early in a physician's education. Studies also suggest, however, that some medical students receive limited opportunities to enter information, including notes and orders, into patient records in EHRs.[4-10] This tends to occur despite their ability to access them generally.

In addition to studies documenting limited opportunities for medical students to enter information into EHRs, other work suggests that this gap in learning opportunities may translate into a lack of competency in the knowledge and skills required at the start of residency training. For example, one study reported that in 2019, 25% of medical school graduates did not think that they were ready to enter and discuss orders and prescriptions.[11] Another study showed that after an 8-hour EHR training session, 30% of postgraduate year-1 residents from a range of specialties still needed assistance performing a number of core EHR activities.[12]

Health system policies, billing integrity, EHR programming, workloads, and time constraints all serve as partial explanations for the documented limited entry of information into EHRs by medical students.[5,6] Recent changes in Centers for Medicare & Medicaid Services (CMS) documentation guidelines may provide incentives to encourage medical schools to facilitate greater medical student participation in EHR entry.[13-15] Other barriers to comprehensive EHR instruction in medical school may be unique to obstetrics and gynecology and may not be able to be addressed by the new CMS ruling.

Given some of the particulars of the practice of obstetrics and gynecology, the ability of medical students to properly enter notes and write orders unique to the discipline likely will benefit graduates of medical school who enter an obstetrics and gynecology training program. For students who enter a program in another specialty area, early EHR instruction and practice in interpreting and entering information pertinent to obstetrics and gynecology may better prepare them for when these types of issues arise in settings outside of clearly-defined obstetrics and gynecology care. Moreover, the basic elements of what is required to effectively use an EHR likely apply across clinical settings and patient concerns. In

this way, clinical learning opportunities in obstetrics and gynecology clerkships that allow students to enact the generic knowledge and skills required of effective EHR use may help prepare them for residency training broadly.

While EHR learning opportunities are an important component of obstetrics and gynecology clerkships, little is known about the extent to and ways in which medical students interact with EHRs during their obstetrics and gynecology training in medical school. To fill this gap, the purpose of this study is to examine student experiences with EHRs during their obstetrics and gynecology clerkships in US medical schools over a five-year period (2012 –2016). A greater understanding of student exposure to EHRs during their obstetrics and gynecology clerkships using a Step 2 Clinical Knowledge (CK) End-of-Examination Survey on EHR will help to evaluate the extent to which students receive adequate EHR educational experiences that can best prepare them for their future training and practice.

Materials and Methods

The Step 2 Clinical Knowledge (CK) End-of-Examination Survey is a web-based survey administered to medical students immediately after they complete the United States Medical Licensing Examination (USMLE) Step 2 CK. Generally, the survey asks students about their medical school and Step 2 CK examination experiences. Different forms of the survey contain both common and unique questions and are randomly assigned to students. One form of the survey included questions asking students about their experiences accessing and entering information into EHRs for the inpatient and outpatient components of their obstetrics and gynecology clerkship. From August 2011 to July 2014, 25% of all Step 2 CK examinees received the EHR survey questions, and from August 2014 to July 2016, 50% of all Step 2 CK examinees were assigned the questions. The proportion of survey forms including EHR questions increased because other survey forms including different special topic questions were retired—thus opening up more space in which to ask the EHR questions.

The EHR survey questions asked students whether 1) they routinely accessed an official EHR, and if

they answered yes, they were then asked to indicate if 2) they entered notes or orders into an EHR. These two questions were asked separately for inpatient and outpatient experiences in obstetrics and gynecology. The survey questions stated that if a student only accessed an EHR to review patient information, they should indicate that they did not enter notes or orders. Students who answered that they entered information into EHRs were asked to indicate whether they entered the following four types of notes and orders into the record during their obstetrics and gynecology *inpatient* rotation only: 1) admission history and physical examination notes, 2) progress notes, 3) admission orders, and 4) post-admission orders. These questions were not asked for outpatient rotations, because admitting history and physical exam notes and orders are not common in ambulatory settings.

The initial dataset was comprised of 83,301 medical students who attended 142 US-based LCME-accredited medical school campuses, planned to graduate medical school between 2012 and 2016, and took the Step 2 CK examination under standard testing conditions. A total of 27,788 students were randomly assigned to the EHR survey during the study period (25% percent of 55,454 [13,864] and 50% of 27,847 [13,924]). A subset of 16,366 students with complete and valid responses to the survey questions was selected for analysis.

A series of student-level dichotomous variables were created. A variable for each of the following three activities was created *separately* for inpatient and outpatient rotations: 1) accessed an EHR, 2) entered information into an EHR, and 3) had read-only access. The "read-only access" variable indicated circumstances in which a student accessed an EHR during the rotation but did not enter information into it. Three additional variables were created to indicate EHR access, EHR information entry, and read-only access *across* both inpatient and outpatient rotations. Four final variables were created to represent the four possible types of notes and orders a student could have entered into EHRs during their inpatient rotations only. The resulting dataset had a total of thirteen dichotomous variables for each student (3 activities * 2 rotations) + (3 activities across both rotations) + (4 activities for inpatient rotations only).

Each of these variables was coded to receive a value of 0 if the student did not engage in the EHR activity and a value of 1 if they did engage in the activity.

Means for each of the 13 variables were calculated by graduation year for the total group and by student gender. For the total group, differences in means for graduation years 2016 and 2012 were computed and chi-square analyses were used to test whether these differences were statistically significant. Chi-square tests were then used to test whether the percentages of students participating in each activity within each graduation year differed significantly by gender. Analyses were performed using IBM SPSS Statistics Version 23.0 (IBM Corp., Armonk, NY), R Version 3.5.2, and R Studio Version 1.1.463. This study was reviewed by the American Institutes for Research Institutional Review Board and qualified for exempt status because it involved very minimal or no risk to study subjects.

Results

Valid survey responses were obtained from 19,546 of the 27,788 students assigned to the EHR survey, for an overall response rate of 70%. Of the students receiving the survey, 19,346 (99%) indicated that they completed an obstetrics and gynecology clerkship and were eligible to receive the EHR survey questions. Responses from a final sample of 16,366 students (7,903 women and 8,463 men) who gave valid responses to the first two survey questions about EHR use and entry of information into EHRs for one or both of their obstetrics and gynecology clerkship rotation components (inpatient and/or outpatient) were selected for analysis. Students not included in the final dataset either skipped or selected the 'unsure' option for one of the first two EHR survey questions for the component in question, or indicated that the rotation component did not exist.

In general, the sample of 16,366 students was reflective of the full dataset of 83,301 students who took Step 2 CK during the study period. Students in both samples had a mean age of 27 years (SD=3). Forty-eight percent of students in the study sample were female, while 47% of students in the full sample were female. The students in the study sample had a mean Step 2 CK score of 243 (SD=18); students in the full

dataset had a comparable mean score of 240 (SD=18). Furthermore, all 142 US-based LCME-accredited medical school campuses associated with the 83,301 students who took Step 2 CK during the study period were retained in the final sample of 16,366 students.

Table 1 presents information about medical student EHR use by graduation year. These results are presented separately for inpatient rotations, outpatient rotations, and across both inpatient and outpatient rotations. Within each graduation year, the percentage of students who entered information into an EHR was much lower than the percentage of students who accessed a record, which was relatively high across all graduation years. As shown, the percentage of students participating in each EHR activity increased significantly over the study period for both inpatient and outpatient rotations. Fewer students participated in all EHR-related activities during their outpatient rotations compared with their inpatient rotations. The magnitude of these differences decreased by the end of the study period for overall EHR access, increased for read-only access, and remained about the same for entry of information.

Table 2 provides the percentages of students who entered different types of notes and orders into EHRs during their obstetrics and gynecology inpatient rotation by graduation year. As shown, the percentage of students entering notes into EHRs was low overall, but increased considerably over the study period. By 2016, 47% of students wrote admission history and physical notes and 58% entered progress notes. Student experiences with writing admission and post-admission orders were strikingly low and actually *decreased* by 4% over the course of the study period. Only 8% of students graduating in 2016 regularly wrote post-admission orders, and a mere 6% wrote admission orders.

Discussion

Principal Findings:

EHR usage by students completing the obstetrics and gynecology clerkship increased over the five years studied. In the final year of the study, 94% of students accessed the EHR, and 69% entered into a

record. Hence, over 30% of students made no entry and did not have the opportunity in their obstetrics and gynecology clerkship to learn and practice both the generic and specialty-specific knowledge and skills thought to inform effective EHR use in practice.

Results:

These results are consistent with another recently published report of EHR use during medical school.[7] The reason for limitation in medical student EHR entry is multifactorial. As the EHR was introduced into many health systems, the perspective of the learner—particularly the medical student—was not of paramount importance. Compliance, billing, and expediency were issues that were in the forefront. As physicians' computer workloads increased, many lacked an appetite for additional work in the EHR in evaluating medical student entries if they were not to contribute to the formal record and were not usable toward billing and formal documentation.[4,5,6,8]

Clinical Implications:

With general agreement about the importance of learning EHR skills, the finding that medical student entry of notes and orders is not a uniform part of the educational experience is concerning. Some of the students who complete obstetrics and gynecology clerkships may end up being deficient in core record-keeping skills—particularly regarding entry of orders and proper writing of notes in an electronic format – while others may not. This potential inequality has implications for students' future educational and professional development and for the quality and consistency of patient care. Just like any other competency, proficiency in EHR use requires repeated deliberate practice and it is important that all students equally learn to enter and interpret notes and orders during their obstetrics and gynecology clerkships, especially given the uniqueness of the discipline. Furthermore, noting the general concern that many residency program directors hold that regulatory limits have made it difficult to cover all substantive requirements within the timeframe of a training program, it is essential that medical school

graduates enter residency training ready to learn and practice the material intended to be taught in their graduate medical education.

Several practical best practices regarding successful incorporation of the EHR into undergraduate medical education in obstetrics and gynecology have been documented in the literature. For example, placement of EHR systems in clearly demarcated, accessible, and central locations, removal of the copy-and-paste functionality for student use, and utilization of existing tools within EHR systems to provide learners with feedback have all been recommended.[16] It is also the responsibility of educators to use a developmental approach to teach and evaluate students' clinical documentation in the EHR. Applying the Reporter-Interpreter-Manager-Educator (RIME) educational framework to teach medical students and residents how best to use EHRs is an example of such a method.[17] Other formal approaches to teaching and evaluating EHR use that are grounded in theory are needed to better identify a learner's developmental progress and to ensure that learners are ready for the different stages of their training

Research Implications:

While this study reflected students' experiences over a five-year period, the timing preceded the introduction of the recent changes in CMS documentation guidelines, which may provide incentives to encourage medical schools to facilitate greater medical student participation in EHR entry. It would be important to examine students' use of EHR again in a few years to see if the experiences have changed. It would also be valuable to follow students longitudinally to examine whether less EHR experience as a medical student translates into lack of preparedness when seeing patients as a house officer and later in independent practice.

Strengths and Limitations:

This study is important as it specifically addressed students' experiences during the obstetrics and gynecology clerkship as reported by the students themselves. It is a large study with a high response rate

capturing students' experiences over a five-year period, which showed that even with the ubiquity of EHRs, students are still not getting enough experiences. The study also has several limitations. Some students did not respond to each survey item. There was a drop-off in responses over the course of the survey, likely due to time constraints. Hence, there is a small amount of missing data. Also, this study did not address experiences in obstetrics and gynecology beyond the core clerkship, when some students may gain additional experience in EHR use during more advanced clerkship rotations. It is important to note that while most medical students intending to practice obstetrics and gynecology are likely to purse an advanced elective or sub-internship before graduation, these advanced educational experiences tend to focus on subspecialties which may not necessarily expose students to the breadth of patient concerns present across the discipline.

Conclusions:

This study presents the results of a national survey of students' experiences engaging with EHRs during their obstetrics and gynecology clerkships. While most students were able to access EHRs during their rotation, some were unable to enter patient information into them. This lack of experience with electronic documentation counters current emphasis from the medical education community placed on allowing medical students to fully utilize EHRs. It also may mean that some students will be ill-prepared for residency training, particularly in obstetrics and gynecology, but also in other specialty areas. The new CMS guidelines may help remedy this situation, as may concerted system-focused efforts by medical schools and medical educators to combat the known challenges associated with student documentation in EHRs.

Acknowledgments:

The authors acknowledge the contributions of Kathleen Z. Holtzman to initial survey design when she worked at the National Board of Medical Examiners.

References

1. Hammoud MM, Dalymple JL, Christner JG, et al. Medical student documentation in electronic health records: a collaborative statement from the Alliance for Clinical Education. Teach Learn Med 2012;24(3):257-266.

2. Association of American Medical Colleges. Core Entrustable Professional Activities for Entering Residency—Curriculum Developers' Guide. https://members.aamc.org/eweb/upload/Core%20EPA%20Curriculum%20Dev%20Guide.pdf Accessed March 26, 2019.

3. Association of American Medical Colleges. Core Entrustable Professional Activities for Entering Resideny: Faculty And Learners' Guide. https://members.aamc.org/eweb/upload/Core%20EPA%20Faculty%20and%20Learner%20Guide.pdf Accessed March 26, 2019.

4. Foster LM, Cuddy MM, Swanson DB, Holtzman K, Hammoud MM, Wallach PM. Medical student use of electronic and paper health records during inpatient clinical clerkships. Acad Med 2018;93(11S):S14-S20.

5. Hammoud MM, Margo K, Christner JG, Fisher J, Fischer SH, Pangaro LN. Opportunities and challenges in integrating electronic health records into undergraduate medical education: a national survey of clerkship directors. *Teaching and Learning in Medicine: An International Journal.* 2012; 24:219-224.

6. Mintz M, Narvarte HJ, O'Brien KE, Papp KK, Durning TM. Use of electronic medical records by physicians and students in academic internal medicine settings. *Academic Medicine*. 2009; 84:1698-1704.

7. Wallach PM, Foster LM, Cuddy MM, Hammoud MM, Holtzman KZ, Swanson DB. Electronic health record use in internal medicine clerkships and sub-internships for medical students graduating from 2012 to 2016. *Journal of General Internal Medicine*. 2019; 34(5):705-711.

8. Welcher MW, Hersh W, Takesue B, Elliot VS, Hawkins RE. Barriers to medical students' electronic health record access can impede their preparedness for practice. *Academic Medicine.* 2018; 93(1):48-53.

9. White J, Anthony D, WinklerPrins V, Roskos S. Electronic medical records, medical students, and ambulatory family physicians: a multi-institution study. *Academic Medicine.* 2017; 92(10):1485-1490.

10. Wittels K, Wallenstein J, Patwari R, Patel, S. Medical student documentation in the electronic medical record: patterns of use and barriers. *Western Journal of EmergencyMedicine.* 2017; 18(1):133-136.

11. Association of American Medical Colleges. Medical School Graduation Questionnaire: 2019 All Schools Summary Report. https://www.aamc.org/system/files/2019-08/2019-gq-all-schools-summary-report.pdf Accessed October 26, 2019.

12. Nuovo J, Hutchinson D, Balsbaugh T, Keenan C. Establishing electronic health record competency testing for first-year residents. *Journal of Graduate Medical Education.* 2013; 5(4):658-661

13. Centers for Medicare & Medicaid Services (CMS). CMS Manual System: Pub 100-04 Medicare Claims Processing Transmittal 2303. https://www.cms.gov/Regulations-and-Guidance/Guidance/Transmittals/downloads/R2303CP.pdf . Accessed March 26, 2019.

14. Centers for Medicare & Medicaid Services (CMS). CMS Manual System. Pub 100-04 Medicare Claims

Processing Transmittal 4068.
https://www.cms.gov/Regulations-and-Guidance/Guidance/Transmittals/2018Downloads/R4068CP.pdf
Accessed March 29, 2019.

15. Power DV, Byerley JS, Steiner B. Policy change from the Centers for Medicare and Medicaid Services provides an opportunity to improve medical student education and recruit community preceptors. *Academic Medicine.* 2018;93(10):1448-1449.

16. Buery-Joyner SD, Dalrymple JL, Abbott JF, Craig LB, Forstein DA, Graziano SC, Hampton BS, Hopkins L, Page-Ramsey SM, Pradhan A, Wolf A., Mckenzie ML. Overcoming electronic health record challenges on the obstetrics and gynecology clerkship. Obstetrics and Gynecology. 2015;126(3):553-558.

17. Stephens MB, Gimbel RW, Pangaro L. The RIME/EMR scheme: an educational approach to clinical documentation in electronic medical records. *Academic Medicine,* 2011;86(1):11-14.

Table 1. Medical student use of the electronic health record by graduation year

Obstetrics and Gynecology Clerkship Component	EHR Activity[a]	Percentage of Medical Students by Graduation Year					Percentage Change 2016-2012[b]
		2012	2013	2014	2015	2016	
Inpatient		**N=1,782**	**N=2,593**	**N=2,571**	**N=3,988**	**N=5,315**	
	Accessed a Record	76	83	88	90	92	17
	Read-Only Access	22	24	24	24	27	5
	Entered Information into Record	54	58	64	66	65	12
Outpatient		**N=1,712**	**N=2,507**	**N=2,514**	**N=3,867**	**N=5,200**	
	Accessed a Record	69	79	84	87	89	20
	Read-Only Access	26	30	30	33	35	9
	Entered Information into Record	43	49	54	54	54	11
Across both Inpatient and Outpatient Components		**N=1,792**	**N=2,608**	**N=2,595**	**N=4,012**	**N=5,359**	
	Accessed a Record	79	87	91	93	94	16
	Read-Only Access	22	25	23	24	26	4
	Entered Information into Record	57	62	68	69	69	11

EHR=electronic health record

[a]'Read-Only Access' and 'Entered Information into Record' are mutually exclusive subsets of 'Accessed a Record.'

[b]$P<.05$

Table 2. Medical student entry of notes and orders into the electronic health record during the inpatient component of the obstetrics and gynecology clerkship by graduation year

EHR Activity	Percentage of Medical Students by Graduation Year					Percentage Change 2016-2012[a]
	2012 N=1,711	2013 N=2,506	2014 N=2,445	2015 N=3,802	2016 N=5,016	
Notes, Admission history and physical	39	42	46	46	47	8
Notes, Progress	46	51	57	59	58	12
Orders, Admission	10	10	8	7	6	-4
Orders, Post-Admission	11	11	8	8	8	-4

EHR=electronic health record
[a]*P*<.05